radio but failed to select the corresponding COM channel; and failing to hear a message over the FM radio because you failed to depress the appropriate pushbutton (usually the TEL pushbutton) to direct the call to the overhead speaker or headphones.

PMA7000MS

The PMA7000MS (Figure 4-3) is CAP's newest audio panel, and is installed in conjunction with the new FM radio (TDFM-136). This audio panel was custom-designed to meet CAP SAR operational requirements. In addition to normal audio panel functions, this unit contains an automatic voice-activated (VOX) stereo intercom system with automatic squelch control.

Figure 4-3

Refer to Figure 4-4. Unit power is turned on and off by pushing the Volume knob. In the Off (or Fail-Safe) position the pilot is connected directly to Com 1 to allow communication capability regardless of unit condition (any time power is removed or turned off the audio selector will be placed in the fail-safe mode). The power switch also controls the audio selector panel functions, intercom, and marker beacon receiver. Unless the Mic Selector is in Com 3 mode, at least one of the selected audio LEDs will be on (Com 1 or Com 2).

The Volume control knob adjusts the loudness of the intercom for the pilot and copilot only; it has no effect on selected radio levels, music input levels or passengers' volume level. Adjust the radios and intercom volume for a comfortable listening level for the pilot. [Most general aviation headsets today have built-in volume controls; therefore, passenger volume can be adjusted on the headset.] For best performance your headset microphone must be placed within ¼ inch of your lips, preferably against them. It is also a good idea to keep the microphone out of a direct wind path.

The Operation Manual may be obtained at www.ps-engineering.com.

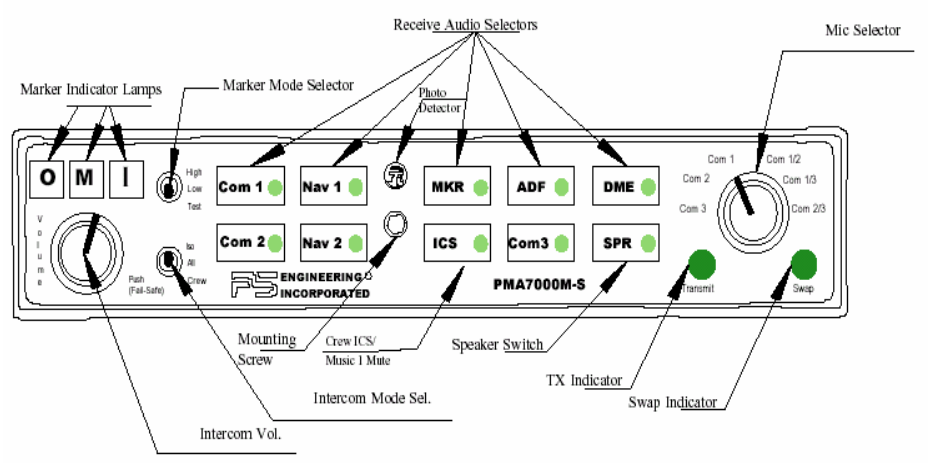

Figure 4-4

Mic Selector switch and receiver switches. Receiver audio is selected through two momentary and six latched, push-button, backlit switches. Because the rotary Mic (microphone) Selector switch controls what transceiver is being heard, the Com l and Com 2 push-buttons are of the momentary type and do not remain in when selected. Because of this, you will always hear the audio from the transceiver that is selected for transmit by the rotary Mic Selector switch (in other words, you can't transmit without listening to the receiver). You can identify which receivers are selected by noting which of the switch LEDs are illuminated. Push buttons labeled Nav 1, Nav 2, COM 3, DME, MKR (Marker), ADF and SPR (Speaker) are "latched" type switches. When one of these buttons is pressed, it will stay in the "in" position; press the switch again and it will be in the "out" position and remove that receiver from the audio. When selected, the SPR button will place all selected audio on the aircraft's overhead speaker (Note: the speaker amplifier is not active in the split mode).

When the Mic Selector switch is in the Com 1 position, both pilot and copilot will be connected to the Com l transceiver. Only the person that presses their Push-to-Talk (PTT) will be heard over the aircraft radio. Turning the rotary switch to the Com 2 position will place pilot and copilot on the Com 2 transceiver. The PMA7000MS gives priority to the pilot's PTT; if the copilot it transmitting and the pilot presses her PTT, the pilot's microphone will be heard over the selected transmitter.

Split Mode. Turning the rotary switch to Com 1/2 places the PMA7000MS into "Split Mode." This places the pilot on Com 1 and the copilot on the Com 2 transceiver. An example of this useful feature is when the pilot may want to talk to Air Traffic Control while the copilot/observer is checking weather with Flight Watch. Switching to Com 1/3, the pilot will be on Com 1 and the copilot will be on Com 3 (the FM radio). In Com 2/3, the pilot is on Com 2 and the copilot on Com 3. [Note: In split mode the pilot and copilot are usually isolated from each other on the intercom, simultaneously using their respective radios. Depressing the ICS button in split mode will activate VOX intercom between the pilot and copilot positions; this permits intercommunication when desired between the crew. Pressing the ICS button again disables this crew intercom function.]

The com antennas are normally mounted on top of the aircraft in close proximity to one another. As a result, if the pilot and copilot are transmitting simultaneously (e.g., Com 1/2) and the frequencies are close together, there may be some "bleed over." This is usually not a problem when one of the persons is using the FM radio (e.g., Com 1/3 or 2/3)

Swap Mode. With an *optional* yoke-mounted switch, the pilot can change from the current Com transceiver to the other. This "Swap Mode" can be used to reverse transceiver selection in the split mode. For example, if the Mic Selector is in the Com 1/2 mode, pressing the swap button will place the pilot on Com 2 and the copilot on Com 1. When the swap mode is active, the swap indicator light (lower right corner of the unit) will illuminate, indicating that the Mic Selector switch position is no longer current. To cancel swap mode, the pilot may either press the yoke mounted switch again or turn the Mic Selector switch to the Com that is active.

The table below summarizes the transmitter combinations:

	Normal		Swap	
Mic Selector	Pilot	Copilot	Pilot	Copilot
Com 1	Com 1	Com 1	Com 2	Com 2
Com 2	Com 2	Com 2	Com 1	Com 1
Com 3	Com 3	Com 3	No Swap	No Swap
Com1/2	Com 1	Com 2	Com 2	Com 1
Com 1/3	Com 1	Com 3	Com 3	Com 1
Com 2/3	Com 2	Com 3	Com 3	Com 2

Intercom Mode. A 3-position toggle switch ("Intercom Mode Sel." in Figure 4-3) allows the pilot to tailor the intercom function to best meet the current cockpit situation. The following description of the intercom mode function is valid only when the unit is not in the "Split" mode (as mentioned before, the pilot and copilot intercom is controlled with the ICS button when in the split mode).

- ISO (up position): The pilot is isolated from the intercom and is connected only to the aircraft radio system. She will hear the aircraft radio reception (and side tone during radio transmissions). The copilot/observer will hear the passengers' intercom and the back seat scanners will hear the copilot's intercom; neither will hear aircraft radio receptions or pilot transmissions.
- ALL (middle position): All parties will hear the aircraft radio and intercom.
- CREW (down position): The pilot and copilot/observer are connected on one intercom channel and have exclusive access to the aircraft radios. Back seat scanners can continue to communicate with themselves without interrupting the pilot or copilot.

The following table summarizes the intercom modes:

Mode	Pilot Hears	Copilot Hears	Passengers Hear	Comments
Isolate	A/C Radios Pilot Sidetone (during radio transmission) Entertainment 1 is Muted	Copilot and passenger intercom Entertainment #1	Passenger and Copilot intercom Entertainment #2	This mode allows the pilot to communicate without the others bothered by the conversations. Copilot and passengers can continue to communicate and listen to music
All	Pilot Copilot A/C Radio Passengers Entertainment #1	Copilot Pilot A/C Radio Passengers Entertainment #1	Passengers Pilot Copilot A/C Radio Entertainment #2	This mode allows all on board to hear radio reception as well as communicate on the intercom. Music and intercom is muted during intercom and radio communications
Crew	Pilot Copilot A/C Radio Entertainment #1	Copilot Pilot A/C Radio Entertainment #1	Passengers Entertainment #2	This mode allows the pilot and copilot to concentrate on flying, while the passengers can communicate amongst themselves.

Because improper setup of the audio panel can lead to confusion and missed radio calls, *do not reposition the switch or any of the pushbuttons without consulting with the Pilot-in-Command*!

4.1.3 Using the VHF FM radio

CAP has authorization to use special frequencies in order to communicate with government agencies and to our own ground forces. For this purpose CAP aircraft have an FM radio that is separate from the aviation comm radios.

This radio is dedicated to air-to-ground communications, and is normally operated by the observer or scanner. Several of the frequencies programmed into the radio are frequencies assigned to CAP by the U.S. Air Force, and are used to communicate with CAP bases and ground teams. Others are programmed at the direction of the Wing Communications Officer (e.g., mutual aid, fire, police, park service, forest service, and department of public service); these frequencies almost always require prior permission from the controlling agency before use.

CAP is replacing the Yaesu and NAT NPX138 radios (see Attachment 2 for an NPX138 operations guide or visit *ntc.cap.af.mil/comm/downloads*). The TDFM-136 will be discussed here; its operating manual can be obtained at *til.ca/download/tdfm136_install.pdf*. The new PMA7000MS audio panel is designed to work with the TDFM-136.

Figure 4-5

The TDFM-136 (Figure 4-5) is a P25-compliant airborne transceiver capable of operating in the 136 MHz to 174 MHz range (digital or analog) in 2.5 KHz increments. It can have up to 200 operator-accessible memory positions, each capable of storing a receive frequency, a transmit frequency, a separate tone for each receive and transmit frequency, an alphanumeric identifier for each channel, and coded squelch information for each channel.

Data can be entered via the 12-button keypad but is normally downloaded from a PC. Operating frequencies, alphanumeric identifiers and other related data are presented on a 96-character, four-line LED matrix display. It is capable of feedback encryption.

National will enter the first four main frequencies (Primary, Secondary, Ground Tactical and Air-to-Ground) and the wing communications officers will enter the rest. Guard 1 will be preset to the Air-to-Ground and Guard 2 to the Primary frequency. Therefore, all you will just have to know is how to *use* the radio.

The radio also has a scan function that can scan any or all of the main channels stored in the preset scan lists; scan lists, if enabled, are set by the wing communications officer.

As shown in Figure 4-5, the radio simultaneously displays two frequencies. The upper line is the Main (MN) frequency and the lower is the Guard (GD)

frequency. Normally, you will be set up to transmit and receive on the Main and be able to receive the Guard frequency. This feature allows mission base to contact you at any time (via Guard), no matter what frequency you are using (Main).

Controls and normal settings:

- The knob above the MN/GD switch is the power switch and controls volume for Main. The knob above the G1/G2 switch is the volume control for Guard.
- The "Squelch" pushbutton is not used (automatic squelch). Don't push it.
- The MN/GD toggle switch selects the frequency on which you will transmit *and* receive. It is normally set to MN.
- The G1/G2 toggle switch selects the Guard frequency you are *monitoring* (G1 = Air-to Ground and G2 = Primary). It is normally set to G1.
- The HI/LO toggle switch selects transmitter power (10 watts or 1 watt). It is normally set to HI.

Keypad operation:

- Pressing and holding "4" (Scroll Memory Down) will let you scroll down through the programmed memories (it wraps around). Upon reaching the desired entry, release the button. "6" (Scroll Memory Up) lets you scroll up. [Note: scroll speed increases the longer you hold the buttons.]
- Pressing "5" (Scan) lets you select a scan list to scan, and to start or stop the scan. Once the scan list you want is displayed press # ENTER to start the scan or press * ESC to stop the scan. [Note: this function must be enabled by the wing communications officer for it to work.}
- Pressing and holding "2" (Display - Brighter) will increase display brightness; "8" (Display - Dimmer) decreases brightness.

When you get in the aircraft and power up the radio it should be set to MN, G1 and HI. Use pushbutton 4 or 6 to select the assigned Main frequency (normally Air-to-Ground), and "004 Air/Grd 149.5375" will be displayed on the upper line. The second line should display the Guard 1 frequency (in this case, the same as Main).

As another example, let's say you are working with the U.S. Forest Service and have their frequency on Main. Mission base, noting that you have not called in your "Operations Normal" report, calls you using the G1 frequency. You will hear mission base over Guard (its set to G1), regardless of what is coming over the Main frequency. You simply take the MN/GD switch to GD and answer "Ops Normal," and then return the switch to MN and carry on with the mission.

4.1.4 Pronunciation

Radios do not always provide crystal clear sound. For example, 5 and 9, or B, D, T, and V may sound the same on a static-filled radio speaker. To minimize confusion, and to increase clarity, pronunciations of certain numbers and alphabetical characters used in radio transmissions have been accentuated.

Numbers are usually transmitted digit-by-digit, but there are some exceptions to that rule. For example, 10,000 is often transmitted as TEN THOUSAND instead of ONE ZERO THOUSAND, and radio frequencies are usually expressed as ONE TWENTY-EIGHT POINT ONE instead of ONE TWO EIGHT POINT ONE.

Table 4-1 provides a sample of how numbers are pronounced when using either the aircraft or FM radio.

Number	Spoken As:	Number	Spoken As:
0	ZERO	9	NINE ER
1	WUN	10	WUN ZERO
2	TOO	11	WUN WUN
3	TREE	33	TREE TREE
4	FO WER	136	WUN TREE SIX
5	FI YIV	500	FI YIV HUN DRED
6	SIX	1478	WUN FO WER SEVEN ATE
7	SEVEN	2100	TOO WUN ZERO ZERO
8	ATE	128.1	WUN TOO EIGHT POINT ONE

Table 4-1

Like numbers, the letters of the alphabet carry distinctive traits of pronunciation. When it becomes necessary to spell difficult words, groups of words, or to identify any letter of the alphabet, the standard phonetic alphabet is used. The word to be spelled will be preceded by the words “I spell.” If the operator can pronounce the word to be spelled, do so before and after spelling the word.

You should express your callsign phonetically when calling, entering, reentering, joining, or rejoining a net, and when difficult operating conditions may result in confusion or mistaken identity. At all other times, phonetic expression of callsigns is not required. Table 4-2 shows the phonetic alphabet pronunciation for each letter.

Letter	Word	Pronunciation	Letter	Word	Pronunciation
A	Alpha	AL FAH	N	November	NOE VEM BER
B	Bravo	BRAH VOH	O	Oscar	OSS CAH
C	Charlie	CHAR LEE	P	Papa	PAH PAH
D	Delta	DELL TAH	Q	Quebec	KEH BEK
E	Echo	ECK OH	R	Romeo	ROW ME OH
F	Foxtrot	FOKS TROT	S	Sierra	SEE AIR AH
G	Golf	GOLF	T	Tango	TANG GO
H	Hotel	HOH TELL	U	Uniform	YOU NEE FORM
I	India	IN DEE AH	V	Victor	VIK TAH
J	Juliet	JEW LEE ETT	W	Whisky	WISS KEY
K	Kilo	KEY LO	X	X-Ray	EKS RAY
L	Lima	LEE MAH	Y	Yankee	YANG KEE
M	Mike	MIKE	Z	Zulu	ZOO LOO

Table 4-2

4.1.5 Prowords

Prowords are pronounceable words and phrases that have been assigned a meaning for the purpose of expediting communications on radiotelephone circuits. Despite their economical uses, a proword, or combination of prowords should not be used to substitute in the text of the message if they will distort, change, or

cause the actual meaning of the message to become unintelligible. Table 4-3 contains a sample of prowords commonly used in radio communication.

TERM	DEFINITION or MEANING
AFFIRMATIVE	Yes.
ALL AFTER	The portion of the message that follows (word).
ALL BEFORE	The portion of the message that precedes (word).
BREAK	I hereby indicate the separation of the text from other portions of the message.
COPY	I understand.
CORRECT	You are correct, or what you have transmitted is correct
CORRECTION	An error has been made in this transmission. Transmission will continue with the last word correctly transmitted.
DISREGARD	The last transmission was in error. Disregard it.
DISREGARD THIS TRANSMISSION	This transmission is in error. Disregard it. This proword should not be used to cancel any message that has been completely transmitted and for which receipt or acknowledgment has been received.
EXEMPT	The addresses immediately following are exempted from the collective call.
FIGURE(s)	Numerals or numbers follow.
FROM	The originator of this message is the address designator that follows.
I READ BACK	The following is my response to your instructions to read back.
I SAY AGAIN	I am repeating transmission or portion indicated.
I SPELL	I shall spell the next word phonetically.
I VERIFY	That which follows has been verified at your request and is repeated. To be used only as a reply to VERIFY.
INFO	The addressees immediately following are addresses for information.
INITIALS	Personal initials shall be spoken phonetically prefixed by the word “INITIALS.”
MESSAGE FOLLOWS	A message that requires recording is about to follow. Transmitted immediately after the call. (This proword is not used on nets primarily employed for conveying messages. It is intended for use when messages are passed on tactical or reporting nets.)
MORE TO FOLLOW	Transmitting station has additional traffic for the receiving station.
NEGATIVE	No or “permission not granted” or “that is not correct.”
OUT	This is the end of my transmission to you and no answer is required or expected.
OVER	This is the end of my transmission to you and a response is necessary. Go ahead; transmit.
PRIORITY	Precedence PRIORITY.
READ BACK	Repeat my message back to me. A request to repeat instructions back to the sender, for the purpose of confirmation. Also, the receiver's reply, repeating the instructions, as in: "Read back is as follows..."
RED CAP	Precedence RED CAP.
RELAY (TO)	Re-transmit this message to...

TERM	DEFINITION or MEANING
ROGER	I have received and understand all of your last transmission. This should not be used to answer a question requiring a yes or no answer.
ROUTINE	Precedence ROUTINE.
SAY AGAIN	Repeat all of your last transmission. Followed by identification data means “Repeat _____ (portion indicated).”
SPEAK SLOWER	Your transmission is at too fast a speed. Reduce speed of transmission.
SPELL, or I SPELL	Please spell, or "I shall spell the next word phonetically.”
STANDBY	I must pause for a few seconds.
THIS IS	This transmission is from the station whose designator immediately follows.
TIME	That which immediately follows is the time or date-time group of the message.
TO	The addressees immediately following are addressed for action.
VERIFY	Verify entire message (or portion indicated) with the originator and send correct version. To be used only at the discretion of or by the addressee to which the questioned message was directed.
WAIT	I must pause for a few seconds.
WAIT OUT	I must pause longer than a few seconds.
WILCO	I have received your signal, understand it, and will comply. To be used only by the addressee. *Since the meaning of ROGER is included in that of WILCO, these two prowords are* never *used together*.
WORD AFTER	The word of the message to which I have reference is that which follows _____.
WORD BEFORE	The word of the message to which I have reference is that which precedes _____.
WORDS TWICE	Communication is difficult. Transmit each phrase or each code group twice. This proword may be used as an order, request, or as information.

Table 4-3

As an example of using phonetic letters and numbers, consider the following hypothetical example:

You want to fly an aircraft, Cap Flight 4239, through Restricted Area R-2403B, just north of Little Rock, Arkansas. You must verify the status of that area before proceeding and can do so with a transmission such as this:

"Memphis Center, CAP FLIGHT FORTY-TWO THIRTY-NINE requests flight through Restricted Area TWO FOUR ZERO THREE BRAVO to Fort Smith at NINER THOUSAND, FIVE HUNDRED if that airspace is not presently active."

If the area is not active, you might receive a reply like this from Memphis Center:

"CAP FLIGHT FORTY-TWO THIRTY-NINE, Memphis Center. Restricted Area TWO FOUR ZERO THREE BRAVO is not currently active. Proceed own navigation to Fort Smith."

Now that the controller has answered the request, you must make one final transmission so that the controller knows you have received and understood his instruction:

"Roger Memphis. FORTY-TWO THIRTY-NINE proceeding direct Fort Smith at NINER THOUSAND, FIVE HUNDRED."

In this communication exchange, both observer and controller were consistent in their messages. On the initial call-up, the observer first identified the station being called, then identified his aircraft fully before transmitting the request. [NOTE: Sometimes a controller will ask you for the type of aircraft, especially where speed and timing is a factor.]

The controller did the same, enabling both parties to know with certainty to whom each was speaking. Only when that positive identification has been established may the parties abbreviate the callsign, as in the observer's later transmissions of "Forty-Two Thirty-Nine."

4.1.6 Code words

Because the frequencies CAP normally uses are not secure, code words and phrases are sometimes used to prevent unauthorized parties from obtaining the information and possibly compromising mission integrity. The incident commander may assign code words and phrases for mission members to use when transmitting important mission information, such as the sighting of the target aircraft, its location, and whether there are survivors.

ICs and communications leaders ensure the codes provided to mission members are exact and complete enough to relay vital information. However, the observer must be sure all the following information is relayed, even when code words are being used:

- The fact that a sighting has been made.
- Location or position of the target in accordance with the grid, map, or chart that is standard to the mission.
- Any survivor information that is available.

Code words and phrases vary according to wing, mission and Incident Commander. In most cases code words are not necessary.

4.1.7 Stuck mike

Occasionally, the transmit button on aircraft radio microphones gets stuck in the transmit position, resulting in a condition commonly referred to as a "stuck mike." This allows comments and conversation to be unintentionally broadcast. Worse yet, it also has the effect of blocking all other transmissions on that frequency, effectively making the frequency useless for communication by anyone within range of the offending radio. You may suspect a stuck mike when, for no apparent reason, you do not receive replies to your transmissions, especially when more than one frequency has been involved. You may notice that the 'T' (transmit symbol) is constantly displayed on your communications radio and, in the case of the PMA7000MS audio panel, the transmit (TX) light in the lower right-hand corner is on continuously. You may notice a different sound quality to the background silence of the intercom versus the noise heard when the microphone is keyed but no one is talking. Often the problem can be corrected by momentarily re-keying the microphone. If receiver operation is restored, a sticking microphone button is quite likely the problem.

4.1.8 CAP FM radio reports

As a minimum, the aircrew must report the following to mission base:

- Radio check (initial flight of the day).
- Take off time ("wheels up").
- Time entering a search area.
- Time exiting a search area.
- Landing time ("wheels down").
- Operations normal ("Ops Normal"), at intervals briefed by mission staff.

4.2 Non-verbal communication

While you are on a mission, nonverbal signals may be the only available method of communication with a crash survivor or with ground teams. Mission aircrews may have to interpret these nonverbal messages and must be able to do so accurately regardless of the method used.

4.2.1 Light gun signals

If the radio in your aircraft fails, it is still very important for you to follow instructions from the tower at a controlled airport. In this case, you may have to rely on light gun signals from the control tower in order to receive the necessary landing and taxi clearances previously described. These clearance requirements still apply despite an inoperative radio. Table 4-4 shows each light gun signal, followed by its meaning.

Color and Type of Signal	On the Ground	In Flight
Steady Green	Cleared for takeoff	Cleared to land
Flashing Green	Cleared to taxi	Return for landing
Steady Red	Stop	Give way to other aircraft and continue circling
Flashing Red	Taxi clear of runway area	Airport unsafe—Do not land
Flashing White	Return to starting place on airport	Not applicable
Alternating Red and Green	General warning — exercise extreme caution	

Table 4-4

4.2.2 Body signals

Use of the body is one of the most common means of sending messages. These signals are called "body signals" since they involve the whole body, not just arm movements. They are easy to use because no special materials are needed. Body signals are shown on the last page of this chapter.

4.2.3 Paulin signals

“Paulin” is a short form of tarpaulin, which means waterproof canvas. If the victims of an accident are fortunate enough to have some paulin material, they may be able to aid the rescuers greatly by sending signals with it (Figure 4-6). It